

Influence of Age, Gender and Handedness in Signature Imitation

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This article studies the influence of age, gender, and handedness on the ability of student volunteers to simulate signatures. The students were enrolled in an introductory course in Hospitality, Tourism, and Event Management at the Metropolitan State College of Denver. The majority learned to write during the 1980s. The volunteers were provided genuine signatures by older writers who learned to write using the Palmer System. The simulations were done in 2 sessions, the 1st with no instructions on how to imitate a signature. A week later the same students were asked to repeat the exercise, but this time with some instructions in how to copy a signature. The students were given an incentive of earning extra points on their grade for good efforts.

The students' forgeries were then evaluated by a forensic document examiner and graded as to quality. In general, the students created very poor forgeries. The females performed slightly better than the males, particularly after instruction, but even those efforts were not very good.

Introduction

"If any person shall falsely forge, or make, or cause or assent to be falsely forged or made, any false deed, charter, or writing sealed...court-roll or will in writing...shall be convicted....he shall pay to the party aggrieved double costs and damages to be assessed by the court....and shall be set on the pillory. And there have his ears cut off, and his nostrils slit and cut, seared with a hot iron; he shall also forfeit to the queen the profits of his lands during life imprisonment" (England, 5 Eliz. C. 15, 1563 A.D.).

This punishment for forgery makes today's consequences seem minimal! Despite the punishment in England in 1563, or the consequences that society today places on the forger, this crime to defraud continues.

The professional forger is an extremely rare breed of individual; he or she is more likely to target major businesses rather than individuals or small businesses (Lowe 2005). The non-skilled forger is an opportunist who sees a chance of "easy money" (*ibid.*).

This research paper will describe the types of forgeries most common to document examination for the purpose of defining terms as they apply to the assignment given to the sample population of the study.

Types of Forgeries/Signature Imitations

The most common type of forgery is *simulation*. To simulate the signature, a forger has to have access to a model of the genuine signature from which to practice making copies. He or she attempts to imitate the pictorial characteristics or general appearance of the writing being copied.

The forger pays close attention to the obvious characteristics such as the appearance of the capital letters. Letters are drawn, rather than written. Forging a signature is a much more arduous task than it might initially appear. Attempting to imitate another signature is akin to mimicking the way someone walks or speaks (Kelly and Lindblom 2006). It requires knowledge of one's own handwriting characteristics so that they can be eliminated and replaced with those of the model.

Another type of forgery is *tracing*. Once again, the forger has a model of the genuine signature, which he may hold against a window or light box with another sheet of paper on the top so that the model shows through and can be outlined. Carbon paper can also be used. Under magnification, hesitations and pen lifts the forger makes as he checks his progress are readily seen (Kelly and Lindblom 2006).

In the *cut-and-paste forgery*, a genuine signature is cut from 1 document and placed on the spurious document.

Closely related to the cut-and-paste forgery is *electronic forgery*. Technology has evolved the scan-and-drop method of forgery by simply digitizing a genuine signature, scanning at a very high resolution, and inserting the signature into the spurious document (Kelly and Lindblom 2006).

The final type of forgery for the purpose of this research paper is the *freehand signature*. The forger simply writes the victim's name without making any attempt to copy (Kelly and Lindblom 2006).

The students at Metropolitan State College of Denver who participated in this research project in May 2008 were asked to simulate the signatures provided. The data analysis and findings of the duplicated signatures are based upon simulated signatures only. The close simulation of a signature takes very astute observation by the forger of the individual nuances of that signature.

Signing a document is 1 of the most common writing acts. With many repetitions over time, a person's signature can become very specialized and complex. The aging process can inject features into signatures that make them hard to simulate.

People usually have 3 different signatures: (1) a formal signature, used on important documents; (2) a routine signature, used on regular correspondence; and (3) an informal signature, used for receipts and the like. Other circumstances that affect writing are age, illness, injury, emotional distress, medication, intoxication, and corrective vision. It is difficult to tell handedness, gender, and age from unknown samples (Hodgson 2006). The students of this study were not told under what circumstances or conditions the signatures to be imitated were obtained.

The Individuality of Signatures

Handwriting has long been considered individual. Court records involving wills, ransom notes, and other documents over many years have provided support for this proposition (Srihari and others 2002). This study will examine how age, gender, and handedness of the would-be forger affects or influences signature imitation. A review of the existing literature provided a framework for the design the study, collection of data, interpretation of the findings, and reporting the results.

Effects and Influence of Age on Handwriting

Handwriting is a motor skill involving hand-and-eye coordination acquired through practice and

instruction. The amount and quality of instruction, as well as muscular coordination and pattern recognition ability of the student, determine how well the skill is mastered (Winchester 1975).

Most students today begin their cursive handwriting instruction at or around the age of 8 or 9. "The style of handwriting through the ages, like the style of clothes or modes of architecture, is indicative of the period in which the writing is done" (ASQDE file #00005352). Handwriting instruction of the 1930s and '40s was unlike penmanship lessons of today (Purtell 1971).

Children learn to write by copying whatever style of writing is fashionable at the time and taught to them by teachers from textbooks. The most popular handwriting instruction systems in the United States for most of the 20th century was either the Palmer Method or the Zaner-Bloser System. Currently there is less time spent on handwriting instruction than was spent 50 years ago during the golden age of handwriting instruction. As the child grows, the act of writing becomes a subconscious effort and begins to pick up habitual shapes and patterns that distinguish it from all others. This is most evident with capital letters and numerals.

Handwriting systems taught today are many and varied. Members of the American Society of Questioned Document Examiners have, on occasion, canvassed the state schools in the United States to compile a record of the writing systems adopted for use within the schools. Nine of 28 states responding to the 1993 survey reported that no specific system was then required to be followed by the teachers of the state schools. The other 19 states cited a wide assortment of the systems such as Tamblyn and Zaner-Bloser. Waldorf is a system unique to the state of Colorado (Huber and Headrick 1999).

The Metropolitan State College of Denver students noted in their signature imitations the year they had received cursive instruction, but none knew the handwriting instruction method they had been taught. The majority of students received cursive instruction in the late 1980s. Due the limitations of their handwriting instruction, the students may not have the skill level to imitate the sample signatures. The students' willingness to participate or their ability to produce quality imitations was low. None of the imitations would have created a challenge to any qualified forensic document examiner.

The students imitated genuine signatures of 3 writers over 50 years of age. The genuine writers

were all trained in the Palmer Method of handwriting instruction and retained characteristics of that system of instruction.

Effects and Influence of Gender on Handwriting

For the past century, a number of researchers have focused on the question of whether or not handwriting reveals the gender of its writer (Hecker 1996). Study results from *The Scientific Examination of Sex Differences in Handwriting*, by Manfred R. Hecker of the Kriminaltechnisches Institut des Bundeskriminalamtes Wiesbaden Germany, 1996, found that, generally speaking, females tend to write bigger, more rounded, and more upright than males. The summed results of the study suggest that a diagnostic tool that fails in 1 out of 4 cases is far beneath acceptability in forensic science.

In the research conducted with the students of the Metropolitan State College of Denver, gender identification was a part of the coding on the respondents' signature imitation sheets. Students did check whether they were left- or right-handed. The totals are noted in the profile of subjects (Tables 5 and 6).

Effects and Influence of Handedness on Handwriting

A study conducted by Jerre Levy on "Hand Inversion in Sinistrals and Lateral Preference: Comments on Searleman, Porac, and Coren (1984) cautions against premature conclusions that inverted handwriting posture is more prevalent for sinistral men with leftward lateral preferences and for women with rightward or mixed lateral preferences. Although this may eventually prove to be true, the findings of Searleman et al. are insufficient for support of this inference. Present-day literature does not disprove this supposition.

The influence of the respondents' handedness in signature imitation was duly noted for reference purposes only and evaluated in the analysis section of the paper.

Research Objectives

The purpose of this study was to determine if age, gender, or handedness influenced the ability to more effectively imitate signatures. The study hypothesis has not been subjected to rigorous scrutiny at the time of this research.

Two study objectives were defined:

1. To provide new empirical research on the effect of age, gender, and handedness with regards to forgery.

2. To make a scientific observation and subsequent contribution to questioned document examination literature.

Materials and Methodology

The study consisted of 3 phases:

1. Data collection in May 2008 from college students with no reference or instruction for imitating a genuine signature.
2. Data collection in May 2008, 1 week later on the same sample population of college students. The 2nd collection of data was given with directions on how to more effectively imitate a genuine signature. (An incentive was provided to the college students to put forth their best duplicating effort. The incentive was extra points toward their final examination.)
3. The researcher then examined and assessed each imitated signature of Data Set One, and Data Set Two. Five variables were used for evaluation of signatures in the examination.
 - a. Variable 1: Size of writing
 - b. Variable 2: Alignment on the baseline
 - c. Variable 3: Movement within letters
 - d. Variable 4: Proportion of letters to each other
 - e. Variable 5: Line quality

Ratings were based on a scale of 1 to 5, where 1 is low and 5 is high.

In the 1st phase of the data collection, known as Data Set One, administered on May 1, 2008, students were given a listing of 6 genuine signatures (Figure 1) on a single white sheet of 8½-by-11-inch HP Everyday Copy and Print Paper. The genuine signature names were:

Elsie Cotiguala
Henry L. James
David J. Pollars
Rita M. Blair
Dorothy Pfeiffer
W.C. Stratford

Students were asked to simulate each of the 6 genuine signatures 3 times on a designated sheet of paper and to label the sheet of paper with the imitated signatures, noting their own age, gender, and handedness in the upper-right corner.

There was no time limit set for each imitated signature. The students were able to use any type of writing instrument available to them. Students took approximately 20 minutes to imitate the 6 signature 3 times.

Data Set Two was given to the same group of students on May 8, 2008. This time students

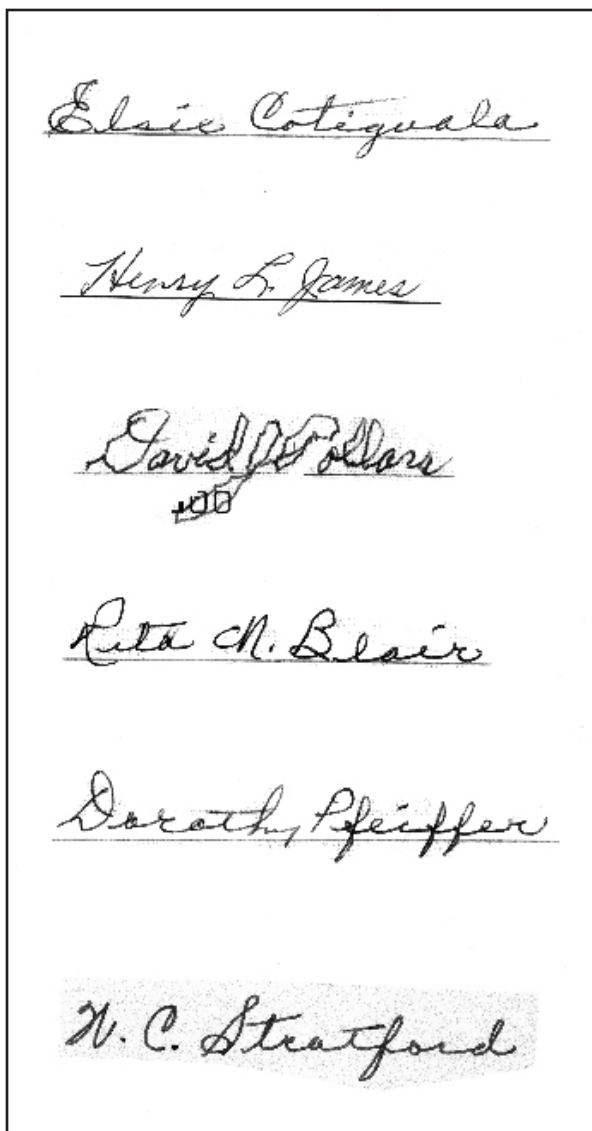


Figure 1. The genuine signatures.

were given a packet with directions for signature duplication, and each student was given the same black-ink ballpoint pen. The cover sheet of directions read as follows:

"You may recall the assignment you completed on May 1, 2008. Today I would like you to repeat the task, but spend a little more time trying to imitate the model signatures as close as you are able.

"When you are finished, place a check mark next to your best imitation of the model signatures. In your efforts consider the following:

1. Size of model signature
2. Proportion of letters to each other

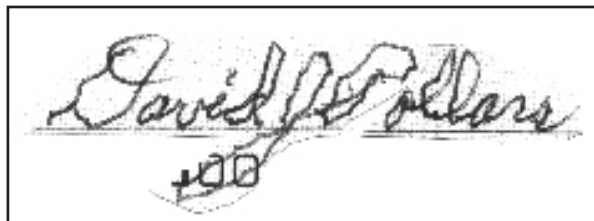


Figure 2. The genuine signature of David J. Pollars.

3. Letter style
4. Line quality – combination of writing speed, skill, freedom of movement, execution rhythm and pen pressure.
5. Skill – degree of ability to write, based upon consistency, uniformity, pen pressure, and general artistic quality.

6. Slant

"The final portion of this assignment is to trace each of the six signatures onto a separate piece of paper one time."

The same 6 genuine signatures were color copied and given in the Data Set Two packet to the students. (The genuine signatures were color copied to aid the respondents to differentiate the letters for imitation purposes.)

Students were once again asked to imitate each of the 6 genuine signatures. Then they were to circle the imitated signature that they determined was their best duplication. Students then noted next to the circled signature why they felt it was the best imitation based on the 6 criteria listed in the packet of directions.

The imitated signatures were examined visually and microscopically to determine their characteristics and establish a value for the 5 variables.

The researcher then selected the genuine signature of David J. Pollars for statistical rating purposes (Figure 2). Using a numbering system of 1 through 5, the following ratings were applied to the evaluation:

- 1 = Very Poor
- 2 = Poor
- 3 = Fair
- 4 = Good
- 5 = Excellent

Study Limitations

1. The results of study may be generalized only to the survey students in the Introductory Hospitality class at Metropolitan State College of Denver. These students are declared majors

Gender N=20		Handedness N=20	
Female 65%		11 Right-Handed Females	
		2 Left-Handed Females	
Male 35%		6 Right-Handed Males	
		1 Left-Handed Male	
Age - Female		Age - Male	
19-20	20%	19-20	15%
21-22	10%	21-22	0%
23-24	0%	23-24	5%
25-26	10%	25-26	10%
27-28	10%	27-28	5%
29-30	5%	29-30	0%
31-32	0%	31-32	0%
33-34	10%	33-34	0%

Table 1. Profile of Subjects in Data Set One, May 1, 2008.

in the field of hotel, restaurant, and event management.

2. The instrument used to gather imitated signatures was simply lined paper with genuine signatures sitting next to the students for duplication and written with a ballpoint pen.
3. The duplicated signature responses of the students were limited to the 6 signatures available during the time of duplication.

Delimitations of the Study

The study was delimited to the students in 1030 Hospitality, Tourism, and Event Management introductory class. Students were not chosen because of their, handedness, gender, or overall handwriting skill level. This class was selected because they were not known forgers and were available to participate in the study.

Study Assumptions

1. Forensic document evaluations are measured by the accepted criterion of size, alignment, movement, proportion, and line quality.
2. Students duplicating genuine signatures make a valid attempt at signature imitation.

Analysis of Data of Data Set One

The profile of subjects for Data Set One (Table 1), where N=20, showed 65% of participants

were female. Thirty percent of the females were between 19 and 22 years of age; 25% were between 25 and 30 years of age; and 10% of the remaining female respondents were 33 and 34 years old. Female respondents in Data Set One were predominantly right-handed. The male respondents were younger, with 70% of the respondents under the age of 26, and a significantly smaller percentage of males being left-handed (Table 1).

The forensic document examiner's evaluations are of 1 signature, "David J. Pollars." All males participating in the study received a 1 rating (very poor) in every category of the scalar values of size, alignment, movement, proportion, and line quality. The mean in all categories was 1 (Table 3).

Female respondents fared mildly better, with a mean of 1.23 in the size category, 1.15 mean in alignment, 1.0 mean in the movement category, a mean of 1.23 in proportion, and 1.07 mean in line quality. Overall, both male and female respondents of Data Set One in all age ranges, right- or left-handed, did a very poor signature imitation. The females appeared to make a more diligent effort to imitate the sample signatures (Table 4).

Analysis of Data of Data Set Two

The profile of subjects for Data Set Two (Table 2), where N=28, also showed a larger percentage of females participating in the study (61%) as

Gender N=28		Handedness N=28	
Female 61%		14 Right-Handed Females	3 Left-Handed Females
Male 39%		8 Right-Handed Males	3 Left-Handed Male
Age - Female		Age - Male	
19-20	14%	19-20	11%
21-22	14%	21-22	11%
23-24	7%	23-24	7%
25-26	7%	25-26	7%
27-28	7%	27-28	3.5%
29-30	3.5%	29-30	0%
31-32	0%	31-32	0%
33-34	7%	33-34	0%
Demographics (N=28) (Elementary attendance in 3 rd and 4 th grade in handwriting instruction)			
Males and Females			
West Coast		8.5%	
Rocky Mountain		78%	
Midwest		3.5	
East Coast		3.5%	
South		3.5%	
International		3.0%	
Total		100%	

Table 2. Profile of Subjects Data Set Two, May 8, 2008.

compared to their male counterparts at 39% participation. Forty-two percent of the female respondents were between the ages of 19 and 26 years of age. Again, right-handedness dominated the female sample population. Fourteen of the female respondents were right-handed. Nearly 40% of the male respondents of Data Set Two were under the age of 28, with no percentage points in the age range of 29 to 34 years (Table 2).

Additional demographics were gleaned from Data Set Two that included the geographical location of the respondents elementary education for handwriting instruction. Thirty-two percent of males attended elementary school in the Rocky

Mountain region, compared to 46% of female respondents. An equal percentage (3.5%) of male and female students received their handwriting instruction internationally.

As in the 1st evaluation of the imitated signatures, the forensic document examiner selected the genuine signature of David J. Pollars for study comparison.

Scalar ratings improved in all categories, but not significantly. The means in all categories for the male respondents in Data Set Two was between 1.27 and 1.54. There was very moderate improvement in the movement and proportion ratings for the males.

	Scale Values					Sample Size	Mean
	Very Poor	Poor	Fair	Good	Excellent		
Category	1	2	3	4	5		
Size	7	0	0	0	0	7	1
Alignment	7	0	0	0	0	7	1
Movement	7	0	0	0	0	7	1
Proportion	7	0	0	0	0	7	1
Line Quality	7	0	0	0	0	7	1

Table 3. Total Percent of Responses to 5 Scalar Values in Each of the 5 Categories, Plus Sample Size and Means Per Category, Data Set One Males, N=20.

	Scale Values					Sample Size	Mean
	Very Poor	Poor	Fair	Good	Excellent		
Category	1	2	3	4	5		
Size	10	3	0	0	0	13	1.23
Alignment	11	2	0	0	0	13	1.15
Movement	13	0	0	0	0	13	1.00
Proportion	11	1	1	0	0	13	1.23
Line Quality	12	1	0	0	0	13	1.07

Table 4. Total Percent of Responses to 5 Scalar Values in Each of the 5 Categories, Plus Sample Size and Means Per Category, Data Set One Females, N=28.

Category	Scale Values					Sample Size 11	Mean
	Very Poor 1	Poor 2	Fair 3	Good 4	Excellent 5		
Size	9	1	1	0	0	11	1.27
Alignment	7	2	2	0	0	11	1.54
Movement	8	2	1	0	0	11	1.36
Proportion	7	2	2	0	0	11	1.54
Line Quality	9	1	1	0	0	11	1.27

Table 5. Total Percent of Responses to 5 Scalar Values in Each of the 5 Categories, Plus Sample Size and Means Per Category, Data Set Two Males.

Category	Scale Values					Sample Size 17	Mean
	Very Poor 1	Poor 2	Fair 3	Good 4	Excellent 5		
Size	4	10	3	0	0	17	1.94
Alignment	2	15	0	0	0	17	1.88
Movement	10	7	0	0	0	17	1.41
Proportion	5	12	0	0	0	17	1.70
Line Quality	11	4	2	0	0	17	1.47

Table 6. Total Percent of Responses to 5 Scalar Values in Each of the 5 Categories, Plus Sample Size and Means Per Category, Data Set Two Females.

Female respondents of Data Set Two showed improvement in all scalar values when evaluated by the forensic document examiner. Females inched closer to a mean of 2 in all categories. The most notable improvement was in the size category to a mean of 1.94. Category ratings ranged from a 1.47 (line quality) to 1.94 (size).

Summary and Discussion of Results

The results of the analysis found that age, gender, or handedness among this sample population of Denver college students did not influence their ability to imitate a genuine signature. The limited data available suggests that further research is needed, specifically the motivation to forge a signature on the part of a college student. One of the comments from a student was, "I'm glad this is over." (This indicates a lack of interest or motivation in the assignment.) It was interesting to observe how many of the imitations were significantly dissimilar to the signature models.

This researcher highly recommends a larger sample size with regard to future studies so that a statistical analysis may be performed. Further literature review and subsequent studies need to address the lack of handwriting systems within school districts.

The forensic document examiner during the evaluation observed that the female college students put forth more of an effort to imitate the genuine signatures than their male counterparts. This was evidenced in the overall category ratings.

References

- American Society of Questioned Document Examiners, (1939). "Handwriting Systems." #00005352, pp.1-5.
- Argamon S.; Koppel M., et al. (2003). *Handwriting and Gender Cues*. pp.1-12.
- Brunelle, R. (1982), *Questioned Document Examination*. pp.1-8.
- Hecker, M. (1996). *The Scientific Examination of Sex Differences in Handwriting*. pp.1-8.
- Hodgson, R. (2006). "Questioned Document Examination: 'The Handwriting on the Wall May be a Forgery.'" Retrieved June 19, 2008, from Austin Peay State University website: <http://apsu.edu/oconnort/3210/3201ect08.htm>.

- Huber, R. and Headrick, A.M. (1999). *Handwriting Identification: Facts and Fundamental*. CRC Press LLC, Boca Raton, FL.
- Kelly, J.; Lindblom, B. (2006). *Scientific Examination of Questioned Documents*. 2nd Ed., CRC Press, Taylor & Francis Group.
- Levy, J. (1984). "Hand Inversion In Sinistrals and Lateral Preference." pp. 445-450.
- Lowe, S. (2005). "Forgery and the Handwriting Expert-What Attorneys Need to Know."
- Lucas, J. (2004). "Catch-A-Thief." pp. 1-6
- Purtell, D. (1971). "Modern Handwriting Instructions Systems and Techniques." American Academy of Forensic Sciences #00002611, pp. 1-9.
- Srihari, S. and Cha, S.H. (2002). "Individuality of Handwriting." *Journal of Forensic Science*. July, pp. 1-17.
- Winchester, J. (1975). "Effect of Age Upon Learning to Write." American Academy of Forensic Sciences #00001258, pp. 1-15.